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FORMAL AUTHORITY VERSUS POWER IN PROFIT MAXIMIZING ORGANIZATIONS

by
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Massachusetts Institute of Technology

WP#3652-94-EFA February 1994

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Formal Authority versus Power in Profit Maximizing Organizations *

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Abstract

I consider a setup in which the firm generally wishes to follow the wishes of individuals (or groups) with large amounts of specific human capital even if their willingness to pay for decisions is less than that of others. Thus, these individuals have power over decisions. In a situation where costly communication prevents the owner of the firm from knowing the valuations employees attach to all decisions, the owner will give formal authority to one individual (or group). I show that, as long as individuals have the possibility of protesting against decisions they do not like, it may be profit maximizing to give this formal authority to someone other than the powerful individual. The reason is that the threat of formal protests by powerful individuals is more effective as a check on the discretion of the person endowed with formal authority.

*I wish to thank seminar participants at IEI in Toulouse for helpful comments

In all but the smallest of firms, authority is delegated in the sense that employees other than the CEO get to make decisions that have a lasting impact on the organization. This delegation is probably the result of costs associated with giving the CEO all the relevant information. Taking information transmission costs as a starting point, the team theory approach originated by Marschak and Radner (1972) allows one to predict the allocation of authority in organizations. In effect, decisions are made by the employee who is best informed about the consequences of the particular decision. A similar conclusion is reached by Jensen and Meckling (1992).

As is widely recognized (Radner 1992) the main shortcoming of the team theory approach is that it regards each employee as maximizing the welfare of the firm without regard to personal objectives. A related defect is that, in practice, decision making inside organization appears to depend rather heavily on individuals' preferences (as opposed to only on individuals' information). One can conclude that preferences matter from the extensive literature that studies who has most influence in organizations (see Pfeffer 1981). Influence over particular decisions (or power) does not seem highly correlated with information about the particular decision's outcomes. Rather, employees who are important to the firm either because they control important resources or because they help it cope with difficulties appear to have disproportionate influence: their wishes tend to be reflected in decisions. In Rotemberg (1993), I provide a model which rationalizes this allocation of power.

While that model matches the observations concerning the ability of groups and individuals to get their way, it does not provide a satisfactory model of the delegation of authority. In particular, it considers a single owner (or CEO) who knows the private benefits that employees derive from all possible decisions and decides directly whose wishes to follow. A more satisfactory treatment would recognize that, as in the team theory approach, the CEO has to rely on information provided by his subordinates to reach a decision. That is what I consider in this paper.

The gathering and transmitting of information is intimately related to issues of authority. In actual enterprises, middle managers gather and transmit information. In practice, this gives them authority because they have a monopoly on the information they gathered so that their choice of what information to transmit tends to dictate what their superiors choose. In other cases, the middle managers make the choice themselves with only minimal reporting to their superiors. But, in corporate life, authority is rarely absolute.

Subordinates who feel that their superior's decisions slight their interests generally have the right to protest to those that lie above their superiors. These are able, and often do, countermand those decisions that have been protested against.

Thus in this paper, authority will be given a very particular meaning. I will regard individuals as having authority over a decision if they can *de facto* dictate the decision by manipulating the information they send upwards. However, I will also incorporate explicitly the notion that the person in authority is subject to protests so that he, in effect, has to worry about the wishes of those whose protests will potentially be heard. Thus the potential for protests reduces the effective power *i.e.*, the ability to get what one wants, of those in authority. However, as long as those who protest must incur some of the costs associated with protests, authority will confer some power although this power will generally fail to be absolute.

The aim of this paper is to consider a very stylized situation in which a firm must choose between two possible organizational charts. What distinguishes the two organizational designs is the tutelage under which a particular activity is located. Consider for concreteness the logistics activity that concerns itself with warehousing finished products and shipping them to customers. This activity relates directly both to the production and to the sales departments of a firm so that it is plausible to place it under the aegis of either department. Whether it is better to locate it under a particular department will obviously depend in part on the technical complementarities involved. In practice, it will also depend on the relative power of the two departments. The issue is then whether, ignoring the technical aspects, the most powerful department should also be given direct control over this particular logistics activity.

While this real world issue motivates my analysis, my model is extremely stylized. I consider two employees and one decisions that has the potential of affecting them both. The employees differ in their specific human capital so that, as in Rotemberg (1993) their power would differ if the CEO had full information about the nonpecuniary utility that the employees draw from various decisions. In particular, the most valuable employee *i.e.*, the one with the most specific capital, would get his way when they are both willing to pay the same amount for the decision. The issue I consider in this paper is whether, once the CEO ceases to have full information about the available options, this valuable employee will also receive formal authority over the decision.

I show that, while there are benefits from giving authority to individuals that the firm wants to empower,

there are costs as well. The cost is that the powerful individual will then choose his favorite outcome even when he thereby gains much less than others would gain with alternate choices. I show that, as a result, it is sometimes attractive to let employees who are less important to the firm have formal authority. This potential separation between formal authority and power is attractive because it has been shown by Thompson (1955) and other subsequent researchers that people without a strong position in the hierarchical structure often have a great deal of power. [1] That is not to say that rank confers no power. Ibarra (1993) shows that people with high rank are likely to be viewed as powerful. But, the main point of her paper is that many other characteristics of employees are related to their power as well.

The paper proceeds as follows. In the first section, I set up a model that is very similar to Rotemberg (1993). In this model one of the two employees is powerful in that the firm would follow its wishes disproportionately if it had access to information about the employee's valuation for the different projects. In the following section, I assume that the firm has to learn the valuations from the individuals themselves and that this transmission of information is costly. Moreover, I assume that there are economies of scale in the sense that an individual employee can credibly transmit the benefits of both employees from a particular project for the same cost as it would cost to transmit information on just his own valuation. [2] The way this should be interpreted is that there are economies of scale associated with describing any particular option. Once an employee describes any particular option, the firm can tell how much nonpecuniary benefits each employee gets. Because of these economies of scale, the firm benefits from requesting the details of a project only from one employee. As we shall see below, this employee will in effect, have authority because the values he transmits largely determine the outcome of the decision. In assuming that economies of scale in the gathering and transmission of information determine the existence of a person who is at the top of a hierarchy, I am following Tirole (1986) and Laffont (1990). [3] While they do not derive their hierarchy, they assume that the person at the top is in charge of transmitting information. That such a hierarchy is hard to

[1] Thompson (1955) provides an example from the military where the official responsibilities of each employee are spelled out in great detail. He shows that, nonetheless employees' *de facto* power can extend to areas for which they are not officially responsible.

[2] The standard mechanism design literature also considers individuals whose valuations are unknown and lets the transmission of this valuation involves a cost (Baron and Myerson 1982). However, in that literature this cost is not independent of the individual's valuation. Instead, information is transmitted by having the individuals with different values sort themselves in terms of the actions they take. Here, instead, I consider the possibility that the individuals can prepare documents that establish their valuation for different outcomes.

[3] They also consider optimal arrangements (or side-contracts) between the person in authority and his subordinates. I neglect these here and assume that no payment can take place between the person who transmits the information and the other employee. While there is a clear incentive for such contracts, they are made difficult by their lack of enforceability in the courts.

derive without making special assumptions about the costs of information flows is suggested by Baron and Besanko (1992).

It seems natural to view the person who is in charge of transmitting the information about one project as having authority since we are used to seeing individuals with authority transmit information upwards. However, authority tends to involve more than just transmission of information. It also generally involves the right to collect information and, more specifically, of asking questions of one's subordinates. In my model, both of these features of formal authority play a pivotal role. In particular, I assume that only the employee with authority can costlessly discover the nonpecuniary benefits of all projects for the other employee.

Thus the employee with authority has several advantages. He gets to scan the private values of alternative projects and transmit upwards the characteristics of a project he likes. The other employee has, as I already described, the right to protest as long as he is willing to incur a cost. The main conclusion of the paper hinges on the fact that the incentive to protest will generally be larger for the more valuable employee. The result is that giving authority to the other employee can be attractive. The strong incentive to protest of the valuable employee ensures that the employee with authority does not abuse his authority in the same way as would the more valuable employee.

A secondary conclusion of the paper is that protests will sometimes be observed in equilibrium. This is attractive because it reproduces a fact of organizational life. Moreover, I demonstrate that employees will protest even though they are not always successful. Protests, like the influence activities of Milgrom and Roberts (1988) take place here because they have the potential for giving more rents to individual employees. They are not always successful because the employee who protests is not sure how much the project can be modified to ensure that it also gives nonpecuniary utility to the employee in authority. This is discovered in the process that takes place following a protest so the outcome of the protest is stochastic.

The third section deals with a related, though somewhat different definition of authority. In this section, the transmission of information is so costly that the employee with authority simply makes his decision without communicating the employees' valuations for the decision. Since the firm does not learn these valuations, employee wages are unaffected by the decisions that are taken.

The aim of this section is to show that the conclusions of section 2 are robust to the introduction of this even larger impediment to information transmission. Putting the employee who is less valuable in charge can

be attractive because the other employee has a larger incentive to protest. The other substantive conclusion of this section is that making wages independent of the decisions that are actually taken need not involve any loss in profits. The optimality of wages that are literally constant requires arises only under special circumstances. However, the fact that profit maximization may involve constant wages suggests something more general. It suggests that the barriers to information transmission that prevent the firm from adjusting its wages may cause only second order losses. [4]

1 The Model

As in Rotemberg (1993) I suppose that there are two risk neutral employees A and B and that a decision needs to be made on which their desires are potentially different. The firm operates for two periods. In each period that employee i remains at the firm, he generates a value equal to v^i. [5] The outside offers of the employees represent the other determinant of their wages. I assume that the firm cannot precommit the value of its future wages and that it does not know the value of these outside offers. To keep the analysis simple, I consider a very simple stochastic structure for these offers. I assume that, in the second period, the outside offer of employee i pays him z_1^i for working elsewhere in that period with probability P while it pays him z_2^i with probability $(1-P)$. Without loss of generality I let

$$z_1^i < z_2^i \tag{1}$$

I also assume that

$$v^i > z_2^i \tag{2}$$

so it is socially efficient for the employee to remain in the second period.

In the first period, the outside offers of each employee guarantee a certain present value of payments for working elsewhere. This present value of payments equals y_1^i with probability P_1, y_2^i with probability P_2 and

[4] The argument has some similarities to the arguments in Mankiw (1985) and in Barro and Romer (1987). Mankiw (1985) starts from the observation that charging a price that differs slightly from the optimum price leads a monopolist to incur only second order losses. Thus, the losses from keeping the price constant in response to a small perturbation are of second order as well. This is similar to my setting in that the firm generally incurs only second order costs when its wage differs slightly from the optimum. However, my result is stronger because a constant price can actually be optimal in my model. In that respect, the model is more closely related to Barro and Romer (1987). They show that constant prices can be optimal in their model of full-day tickets at ski resorts because the price of the thing people actually care about (namely ski-lift *rides*) is effectively varying even though the posted price for full-day tickets is constant. Similarly, the constant wage in my model is consistent with variations in total compensation, although these variations are not due to a congestion effect like that in Barro and Romer (1987).

[5] This is the wage of any potential replacement plus the difference between the revenues generated by the employee and those generated by the replacement.

y_3^i with probability $(1 - P_1 - P_2)$. Once again, I let

$$y_1^i < y_2^i < y_3^i \tag{3}$$

I will also assume that y_3^i is smaller than the present value of the benefits the firm gathers by keeping the employee for two periods. Assuming that the firm does not discount the future, this present value equals $2v^i$ so this requires that $2v^i > y_3^i$. The result is that it would be efficient for the firm to pay a present value of y_3^i and avert all departures.

From the point of view of the owner of the firm, there are a great many potential projects which differ in terms of the revenues that they generate and in terms of the nonpecuniary utility that they generate for both employees. To simplify the analysis, I will assume below that while the owner does not know the characteristics of potential projects, he does know that there exist some projects which have an acceptable pecuniary return. In other words, he knows that there exist projects which raise revenues by R for a fixed investment of N. To reduce the need for transmission of costly information, the owner entertains only projects which meet these specifications. [6] While projects that meet them exist, the nonpecuniary benefits that they provide are *ex ante* random. I denote by x_j^i the nonpecuniary benefit that employee i attaches to a particular project j. I assume that the x's provided by the projects that are feasible (*i.e.*, that satisfy the financial constraints) are initially unknown. What is known is that the x_j^i's can take three values, namely h, ℓ and 0. In this section, I let the owner also know the values attached by employees to the various projects. Costly information transmission is taken up in the next section.

Suppose first that the project that has been implemented gives no nonpecuniary benefits to either employee. This provides a good baseline for understanding the firm's choice of projects. I now compute the wages of both employees in both periods as well as the profits of the firm. In the second period the firm effectively faces a choice between paying z_1^i and z_2^i. The former keeps the employee with probability P while the latter keeps him with probability one. The firm is better off paying the lower wage as long as

$$v^i - z_2^i < P(v^i - z_1^i) \qquad \text{or} \qquad (1-P)(v^i - z_1^i) < z_2^i - z_1^i \tag{4}$$

which I will assume throughout.

[6] One could justify this by assuming that no superior projects exist.

I now turn to the analysis of the first period. Here the firm essentially has a choice of whether the present value that employees can expect by staying is y_1^i, y_2^i or y_3^i. These lead to employees remaining with probability P_1, $P_1 + P_2$ and one respectively. I now compute the expected present value of earnings of an employee that remains in the first period. To do this, I assume for simplicity that neither the firm nor the workers discount future payments. Since (4) implies that employees receive z_1^i in the second period if they remain with the firm for both periods, remaining in the first period in exchange for a first period wage of w leads to an expected present value of earnings equal to

$$w + Pz_1^i + (1-P)z_2^i \tag{5}$$

Paying the wage that leads to an expected present value of y_1^i maximizes expected profits if

$$P_2[v^i(1+P) - y_1^i + (1-P)z_2^i] < (P_1 + P_2)(y_2^i - y_1^i) \tag{6}$$

and

$$(1-P_1)[v^i(1+P) - y_1^i + (1-P)z_2^i] < (y_3^i - y_1^i) \tag{7}$$

Profits are maximized by paying the first period wage that leads to a present value of y_2 if (6) does not hold while

$$(1-P_1-P_2)[v^i(1+P) - y_2^i + (1-P)z_2^i] < (y_3^i - y_2^i) \tag{8}$$

holds. Finally, a wage that leads to a present value of y_3^i maximizes profits if (7) and (8) both fail to hold. For purposes of illustration I will assume that (6) and (7) hold so that the equilibrium wage in the first period leads to a present value of y_1^i. The purpose of this assumption is to ensure that decisions that give more nonpecuniary utility to individual employees also have the potential for raising their total compensation.

I now consider the effect of decisions that give employee i a nonpecuniary utility x if he remains at the firm (where x can take the value of h or ℓ). As in Rotemberg (1993), such decisions can change the probability that the employee remains in the second period. To see this, note that the employee now leaves in the second period when his outside offer equals z_2^i if his wage in the firm is smaller than $z_2^i - x$. Since a similar analysis applies when his outside offer equals z_1^i, the firm effectively has the choice of paying $z_2^i - x$ or $z_1^i - x$. The latter is more profitable if

$$(1-P)(v^i + x - z_1^i) < z_2^i - z_1^i \tag{9}$$

For large enough x, (9) can be violated even though (4) holds. This means that the firm retains the employee with probability one if x is sufficiently large. I will assume that h is sufficiently large that the firm does indeed keep with probability one any employee whose x is equal to h.

I will be concerned with the case in which employee A has more specific human capital than B. This occurs in particular if v^A is larger than v^B, though a similar analysis applies when the internal values are similar but A's outside offers are lower (which is also consistent with having capital that is relatively less valued outside the firm). In either case, (9) is more likely to be violated for A. To keep the analysis simple, I will focus on the case where the z's (and the y's) are the same for both employees but where

$$v^A > v^B \tag{10}$$

Given (10), it is possible that, when x is equal to ℓ, (9) is violated for A while it holds for B. Alternatively, it is possible that, in this case, (9) holds for both employees. I will consider both cases below. The case where (9) is violated for both employees when $x = \ell$ adds little new insights.

I now turn to the analysis of the first period. One interesting case is where both employees gain some rents when the firm adopts a project that gives them nonpecuniary utility of ℓ and gain even larger rents when the firm adopts a project whose nonpecuniary utility is h. In this case, the employees' taste for projects is perfectly correlated with the nonpecuniary utility that they derive from them. This case thus has some obvious intuitive appeal. For this perfect correlation to obtain, it must be the case that the firm pays first offer wages that induce a present discounted value of earnings of y_2^i when the project's nonpecuniary payoff is ℓ while the present value is y_3^i when the nonpecuniary payoff is h.

When the nonpecuniary payoff is h, employee i stays for sure in period 2 and gets z_2^i of total compensation in that period. Accepting to stay in the first period with a wage of w thus leads to an expected present value of

$$w + z_2^i + h$$

To ensure that the firm chooses a present value of y_3^i in this case, we must have

$$(1 - P_1)[2(v^i + h) - y_1^i] > (y_3^i - y_1^i) \tag{11}$$

and

$$(1 - P_1 - P_2)[2(v^i + h) - y_2^i] > (y_3^i - y_2^i) \tag{12}$$

These inequalities are consistent with (7) and (8) because h is large and because paying a high wage in period 1 leads to v^i being earned by the firm with higher probability in the subsequent period.

Since (11) and (12) hold for both employees, both earn a present value of y_3^i if a project is implemented that gives them h in nonpecuniary utility. This makes any employee whose outside offer in the first period falls short of this present value strictly better off. The employee is also strictly better off if the decision that gives him a nonpecuniary benefit of h is taken before he knows the value of his first period outside offer. His expected present value of income rises at that point by

$$P_1(y_3^i - y_1^i) + P_2(y_3^i - y_2^i) \tag{13}$$

Thus employee A and B are willing to pay the same to have such a project implemented. The firm's gain, however, is different. Implementing a project that gives A a nonpecuniary utility of h gains the firm

$$2v^A - y_3^A + 2h - P_1[v^A(1+P) - y_1^A + (1-P)z_2^A] \tag{14}$$

An analogous equation applies when the firm implements a project that gives B a nonpecuniary benefit of h. It thus follows immediately that, assuming (10) holds, the firm gains more from implementing the project that helps A. In particular, the gain from implementing a project whose nonpecuniary utility for A is h versus that of implementing one which gives this much nonpecuniary utility to B is

$$(v^A - v^B)(2 - (1+P)P_1) \tag{15}$$

This is positive if v^A exceeds v^B. This the essence of Rotemberg's (1993) conclusion that valuable employees have power in the sense that the firm wants to accommodate their wishes.

I now turn to considering the effect of projects which give nonpecuniary utility of ℓ. I start with the case where the implementation of such a project is not sufficient for the firm to keep employee i with probability one in the second period. Thus his second period wage is $z_1^i - \ell$. For any given wage in the first period, the present value of the employee's compensation is thus

$$w + \ell + Pz_1^i + (1-P)z_2^i$$

Thus, the wage that gives a present value of y_2^i is optimal if

$$P_2[(v^i + \ell)(1+P) - y_1^i + (1-P)z_2^i] > (P_1 + P_2)(y_2^i - y_1^i) \tag{16}$$

and

$$(1 - P_1 - P_2)[(v^i + \ell)(1 + P) - y_2^i + (1 - P)z_2^i] < (y_3^i - y_2^i) \tag{17}$$

Because ℓ is positive, (16) can be consistent with (6). Assuming (16) and (17) hold, employee i gains $y_2^i - y_1^i$ when the firm adopt the project that gives him ℓ and his outside offer turns out to involve a present value of y_1^i. Thus, his *ex ante* gain from this adoption is

$$P_1(y_2^i - y_1^i) \tag{18}$$

Thus the gain of both employees is the same. The firm's gain from implementing a project that gives the equivalent to ℓ in nonpecuniary compensation to employee i is

$$P_2[v^i(1 + P) + (1 - P)z_2^i] + (P_1 + P_2)(\ell(1 + P) - y_2^i) + P_1 y_1^i \tag{19}$$

So that it is, once again, bigger for the employee whose value v^i is higher. The gain to choosing a project which gives ℓ to A is even higher if the result is that the firm keeps A with probability one in the second period. The firm then gains

$$(P_1 + P_2)(2v^A - y_2^A + 2\ell) - P_1[v^A(1 + P) - y_1^A + (1 - P)z_2^A] \tag{20}$$

which exceeds (19) because v^A exceeds z_2^A.

Individual projects potentially provide nonpecuniary benefits to both employees. Let there be I feasible projects indexed by i. Each feasible project i can be described by a vector $\{x_i^A, x_i^B\}$ which gives the amounts of income that A and B would have to receive to be indifferent with respect to the nonpecuniary utility generated by the project. A's favorite project among all the feasible ones is denoted by α. This project satisfies

$$x_\alpha^A \geq x_i^A, \ \forall i \leq I \qquad \text{and} \qquad x_\alpha^B \geq x_j^B, j \ni x_j^A = x_\alpha^A \tag{21}$$

The first inequality ensures that no project has a higher value for x^A. To eliminate results due to inefficient choices when agents are indifferent the second inequality ensures that, conditional on receiving a given level of utility, A prefers projects that make B better off. Similarly, β, the project that B prefers, is defined by

$$x_\beta^B \geq x_i^B, \ \forall i \leq I \qquad \text{and} \qquad x_\beta^A \geq x_j^A, j \ni x_j^B = x_\beta^B \tag{22}$$

Table 1
Possible Characteristics of β for each α

α	Possible features of β				
$\{h,h\}$	$\{h,h\}$				
$\{\ell,h\}$	$\{\ell,h\}$				
$\{0,h\}$	$\{0,h\}$				
$\{h,\ell\}$	$\{h,\ell\}$	$\{\ell,h\}$	$\{0,h\}$		
$\{\ell,\ell\}$	$\{\ell,\ell\}$	$\{0,h\}$			
$\{0,\ell\}$	$\{0,\ell\}$				
$\{h,0\}$	$\{h,0\}$	$\{\ell,h\}$	$\{\ell,\ell\}$	$\{0,h\}$	$\{0,\ell\}$
$\{\ell,0\}$	$\{\ell,0\}$	$\{0,\ell\}$	$\{0,h\}$		
$\{0,0\}$	$\{0,0\}$				

The presence of the second inequalities in (21) and (22) reduces the potential disagreements between A and B. Nonetheless, there do exist circumstances where α differs from β. In other words, there are situations where one employee can gain nonpecuniary utility at the expense of the other. Since these play a crucial role below, Table 1 displays all the possible characteristics of project β for each possible configuration of α.

Assuming the firm picks α, B can only be unhappy if Table 1 associates the α project with more than one possible description of β. Thus Table 1 indicates the characteristics of α that are potentially associated with disagreements.

The firm's ranking of projects depends on how much each employee gains. In cases where α and β coincide, the firm's favorite project is obviously α as well. The problems arise in those cases where α and β differ. The firm may then prefer α, β, or a compromise project that is the favorite of neither agent. What is certain, however, is that for any given value of α, Table 1 also gives all the possible project descriptions that the firm could possibly prefer to α. To rank these projects, I let $g(x^A, x^B)$ denote the gain to the firm from implementing a project that gives nonpecuniary utility equivalent to x^A units of income to A and to x^B units to B. Because the payoffs from giving nonpecuniary utility to one employee are independent of the nonpecuniary utility of the other,

$$g(x,y) = g(x,0) + g(0,y) \tag{23}$$

Table 2
Projects whose ranking is ambiguous

$\{h,0\}$	$\{\ell,h\}$
$\{h,0\}$	$\{\ell,\ell\}$
$\{0,h\}$	$\{\ell,\ell\}$
$\{0,h\}$	$\{\ell,0\}$

I have shown that A's larger value implies that $g(x,0)$ is larger than $g(0,x)$ for any positive x. Thus, we also have

$$g(x,y) > g(y,x) \qquad \text{if } x > y \tag{24}$$

Table 1 can be seen as displaying all the project payoffs that the firm could conceivably prefer to α. The inequality (24) then determines the firms preference among these pairs except for those pairs displayed in Table 2.

2 The Delegation of Information Transmission

Because only A and B have information about the characteristics of different projects, the firm must, if it wishes to carry out a profitable investment, pay at least one employee for the transmission of a project's description. [7] I assume that the cost of allowing one employee to gather information from the other and transmitting the details of a project is C_1. Moreover, at an additional cost of C_2, the second employee can also transmit the details of another project. I will show that the firm often benefits from paying only for the transmittal of one project by one employee. Because this employee also gathers information from the other employee, it seems natural to regard him as having formal authority.

To keep the analysis manageable, I assume that both employees are equally adept at gauging the consequences of all projects for both their own utility and for firm revenues. In practice, those in authority are also given resources that facilitate the evaluation of revenue impacts but I neglect this for the sake of simplicity.

[7] This hinges on the assumption that these projects are directly profitable. If their only benefit is that hey provide nonpecuniary benefits, the firm might be better off not asking for this information at all and simply giving authority to one employee directly.

If A is given authority and B never reports the value of any projects, the firm implements whatever project A reports. The result is that A would always report the characteristics of α, his favorite project. Depending on the ambiguities surrounding the projects displayed in Table 2, this reported project will sometimes differ from what the firm would implement if it had full information on all projects.

2.1 Optimality of A's authority

There is one case, however, where letting A choose α is in fact optimal from the point of view of the firm. In particular, this occurs if

$$g(\ell, 0) > g(0, h) \qquad \text{and} \qquad g(h, 0) > g(\ell, h) \tag{25}$$

The first inequality implies that $g(\ell, \ell)$ is also larger than $g(0, h)$. Moreover, the second implies that $g(h, 0)$ is larger than $g(\ell, \ell)$ so that all the ambiguities in Table 2 are resolved in favor of A's preferences. Basically, the first inequality implies that, when A cannot get more than ℓ from any project, there is no project that the firm prefers to α. The second inequality ensures that the same is true when A gets h from a project. In this case, the firm ought to give authority to A and this authority is in some sense absolute, there is never any reason for the firm to favor an option that makes B better off than the choice favored by A.

However, this is an extreme case. Matters are less favorable to giving authority to A when the second inequality in (25) is reversed. This would occur if the difference between v^A and v^B is small. In that case, the second inequality in (25) is reversed because the difference between $g(h, 0)$ and $g(0, h)$, (15), can be small relative to the profits from having A get nonpecuniary utility which is worth ℓ to him. The violation of the second inequality in (25) captures a very plausible scenario. In this scenario, the firm prefers some projects that the less valuable employee adores to projects that give only a tiny bit of extra utility to A.

For purposes of illustration, I concentrate on the case where, in addition to the violation of the second inequality of (25),

$$g(0, h) > g(\ell, \ell) \tag{26}$$

It follows immediately that $g(0, h)$ is also larger than $g(\ell, 0)$. Since $g(h, 0)$ is larger than $g(0, h)$, it follows from (26) that $g(h, 0)$ is also larger than $g(\ell, \ell)$.

Suppose that A gets to choose the project and that he can expect B never to protest. He would then

choose α. If the resulting project gives h to B, Table 1 indicates that α and β coincide so that nothing is lost from giving authority to A. Similarly, nothing is lost when α has nonpecuniary payoffs of $\{h, \ell\}$ since $g(h, \ell)$ exceeds $g(\ell, h)$ which itself exceeds $g(0, h)$. However, there are three cases in which α differs both from β and from the firm's ideal outcome. The first is when α entails $\{\ell, \ell\}$ and there also exists a project described by $\{0, h\}$. In this case, (26) implies that the firm is better off with the latter. The same inefficiency arises in the second case, namely when α is given by $\{\ell, 0\}$ while a project with $\{0, h\}$ is available. Finally, the third is when α has nonpecuniary payoffs given by $\{h, 0\}$ while $\{\ell, h\}$ is available. The violation of the second inequality in (25) implies that the firm is better off with $\{\ell, h\}$ in this event.

2.2 B's Protests

The issue is then whether B would protest in these three instances. If such a protest leads the firm to move from a project that gives him non nonpecuniary utility to one that gives him a nonpecuniary utility equivalent to h, his gain is given by (13). Thus, in the last two instances, his gain is

$$P_1(y_3^i - y_1^i) + P_2(y_3^i - y_2^i) - C_2 \tag{27}$$

In the first case, the protest only leads to a change in his already positive nonpecuniary utility. Thus his gain from protesting is

$$P_1(y_3^i - y_2^i) + P_2(y_3^i - y_2^i) - C_2 \tag{28}$$

Even when the expression in (27) is positive, it is not certain that B will protest in the third case, when α features $\{h, 0\}$. The reason is that B does not know the nonpecuniary utility that A draws from alternative projects. At best, he knows that projects exist which give him nonpecuniary utility equivalent to h. Even assuming that he knows which of all the projects that give him h is the best for A, he does not know how much A gets when such a project is adopted. This, he discovers only if he protests.

B does know is that no feasible project is described by $\{h, h\}$ (since A would have preferred this as well). Thus B's uncertainty concerns whether the project from which he gets h gives ℓ or zero to A. If it does the latter, the protest will be to no avail since the firm will prefer α. So, I'll suppose that there is a probability Q that the project that gives h to B and which appears best for A gives ℓ to A. B will then find protesting worthwhile if

$$Q[P_1(y_3^i - y_1^i) + P_2(y_3^i - y_2^i)] \geq C_2 \tag{29}$$

Suppose that the expressions in (27) and (28) are positive and that (29) holds. Then B will get his way in all three contested cases. What is less clear is whether A would immediately offer the outcome that B and the firm prefer or whether B will have to protest to get his way. In other words, there is an equilibrium where A always proposes α. In this equilibrium B protests when A proposes projects with $\{\ell, \ell\}$, $\{\ell, 0\}$ or $\{h, 0\}$ as long as he observes that a project exists that gives him h. But, there are also equilibria where A always proposes $\{0, h\}$ when such a project is available and α is given either by $\{\ell, \ell\}$ or $\{\ell, 0\}$. The reason so many equilibria exist is that A is essentially indifferent as to what he does in the cases where B is sure to succeed if he protests and can be expected to protest if A reports α.

To avoid this indifference, I assume that a protest by B has a cost for A as well, and I denote this cost by C_3. This can be thought of as the cost of delivering credible information on A's valuation of B's proposed project. In the presence of even a trivial cost of this type, A will propose $\{0, h\}$ when such a project is feasible and α is given either by $\{\ell, \ell\}$ or $\{\ell, 0\}$.

Matters are more complicated when $\{\ell, h\}$ is available but α equals $\{h, 0\}$. If A is expected to propose α with probability one, then the fact that (29) is positive implies that B protests with probability one. Since A then loses C_3, this is not an equilibrium. Nor can there be an equilibrium where B never protests because A would then choose α with probability one. The equilibrium must thus involve mixed strategies. In equilibrium A proposes $\{h, 0\}$ with probability one if $\{\ell, h\}$ is not available and with probability π_A if it is. Thus, B's benefit from protesting is

$$\pi_A Q[P_1(y_3^i - y_1^i) + P_2(y_3^i - y_2^i)] - C_2 \tag{30}$$

In equilibrium, π_A is such that this expression is zero so that B is indifferent between protesting and not protesting. He thus protests with probability π_B. This probability must in turn be such that A is indifferent as to what he reports. His gain from reporting α is

$$(1 - \pi_B)[P_1(y_3^i - y_1^i) + P_2(y_3^i - y_2^i)] - \pi_B C_3$$

which must be zero in equilibrium. Note that a high value for the left hand side of (29), *i.e.*, a large gain from getting one's way, implies that the probability that the probability that A proposes the wrong project (π_A) is low while the probability that B protests a suspicious project is high. Thus the outcome is more likely to be efficient.

So far I have treated the costs C_2 and C_3 as incurred by the individuals themselves as opposed to by the firm. However, the firm probably could pay for some of these costs itself by, for instance, giving individuals time and resources to mount their protests. Suppose that A has proposed $\{h,0\}$ and that B knows about a project that gives him h. If B protests, the firm has a probability Q of gaining the expression in (19) (with A replacing i) at the cost of losing the expression in (15). Thus its total gain is

$$Q\{g(\ell,0) - [g(h,0) - g(0,h)]\} \tag{31}$$

While the violation of the second inequality of (25) implies that this is positive, it could well be smaller than the private gains to B, which are given by the left hand side of (29). They could thus be smaller than C_2 so that the firm would not gain *ex post* by financing B's protest. Of course, the firms would love to commit itself in advance to pay for such protests so that the cost faced by B is negligible while the cost that A must pay to defend himself remains bounded away from zero. The reason is that, as one can see by setting the expression in (30) to zero, is that A's response to a low value of C_2 is to grant B's wishes right away and set π_A near zero. But, it seems likely that in practice the firm cannot commit itself in this way so that the fact that (31) is below C_2 implies that individuals must pay for the cost of their protests themselves.

2.3 Optimality of B's Authority

I now suppose that (29) is violated so that B does not protest a project that implies $\{h,0\}$ even when he has identified a project that gives him h. I continue to suppose that (26) holds while the second inequality of (25) is violated so that α is not always optimal for the firm. I show now that, under these circumstances, it sometimes pays to let B have authority.

To maintain symmetry, I assume that if A knows that a project with $\{h,h\}$ is unavailable but knows of a project that gives him h, he assigns probability Q to the event that this project gives ℓ to B. Thus the violation of (29) also implies that A will fail to protest under some circumstances. Nonetheless, giving authority to B is profitable under the conditions of Proposition 1.

Proposition 1: *Let λ_1 be the probability that α and β are associated with nonpecuniary payoffs of $\{h,0\}$ and $\{\ell,h\}$ respectively. Let λ_2 be the probability that they are associated with $\{h,\ell\}$ and $\{\ell,h\}$ while λ_3 is the probability that they are associated with $\{\ell,0\}$ and $\{0,\ell\}$. Then giving authority to B is more profitable*

if

$$\lambda_1\{g(\ell,0)-[g(h,0)-g(0,h)]\} - \lambda_2\{[g(h,0)-g(0,h)]-[g(\ell,0)-g(0,\ell)]\}$$
$$- \lambda_3\{[g(\ell,0)-g(0,\ell)]\} > 0 \tag{32}$$

Proof: To go systematically through all the possible outcomes, exchange α for β in Table 1 and replace $\{x^i, x^j\}$ with $\{x^j, x^i\}$. I then proceed to consider the rows of Table 1. In the first three rows, A gets h when B reports β. The outcome is efficient because B picks β in this case and neither the firm nor A can do better. When β involves $\{\ell, h\}$ and $\{h, \ell\}$ is available, A and the firm would prefer the latter. However, because A would lose his protest if only $\{h, 0\}$ were available and (29) is violated, A does not protest so the outcome is inefficient.

If B were to propose $\{\ell, \ell\}$ when $\{0, h\}$ is available, A would protest because he would know that a project that gives him h is available and that he would thus win his protest for sure. Knowing this, B would propose $\{0, h\}$. Neither would any inefficiency be present in the case where β gives $\{\ell, 0\}$.

The case where β gives nonpecuniary utility equivalent to $\{0, h\}$ also fails to create inefficiencies. The alternatives $\{\ell, \ell\}$ and $\{\ell, 0\}$ are inferior. On the other hand, if an alternative project were available that gives h to A, it will be preferred by the firm so A would protest. Thus, B bows to A's wishes in this case. The same argument implies that B will propose $\{h, 0\}$ when β is given by $\{0, \ell\}$ while $\{h, 0\}$ is available.

Lastly, there is the issue of what will occur when β is given by $\{0, \ell\}$ while $\{\ell, 0\}$ is also available. If the expression in (18) exceeds C_2, A protests and wins. But, if this expression is smaller than C_2, A does not gain by protesting even though such a protest would lead to a more favorable project being implemented. The result would then be that this outcome is inefficient.

The benefit of giving authority to B (relative to giving it to A) is thus that the firm gets the efficient outcome when α and β have nonpecuniary payoffs of $\{h, 0\}$ and $\{\ell, h\}$ respectively. The cost is that the outcome is potentially inefficient in the events whose probabilities equal λ_2 and λ_3. Thus, giving authority to B is more profitable, when (32) holds.

■

The key to the proof is that an efficient outcome obtains when β gives nonpecuniary payoffs of $\{0, h\}$ while a project whose payoffs equal $\{h, \ell\}$ is available. This was not the case when the roles were reversed

because B could not be sure to win if he protested. Because A is more powerful, he can be sure to win his protest when he sees a project that gives him h while B's proposal gives him no nonpecuniary utility. The result is that B makes the right decision. In other words, A's power prevents B from imposing a very bad outcome on A.

There is still the question of when (32) is likely to hold and whether it is consistent with the other conditions I have written down. That there is no inconsistency will be demonstrated below, when I give numerical values to all the parameters and show that, for these values, (32) and the other conditions are satisfied. To get a more general intuition on what (32) requires, it is useful to consider the special case in which λ_1 is equal to λ_2 and λ_3. Then, (32) becomes

$$\lambda_1\{g(\ell,0) - 2[g(h,0) - g(0,h)]\} > 0$$

Thus, it is profitable to give authority to B when the difference in profits between implementing A's favorite and B's favorite project is not too large relative to the value of implementing a project from which A derives some utility. In this case, giving A authority is relatively unattractive because A is too tempted to pass over projects that benefit B a lot while giving him an intermediate level of utility in favor of projects that give A a lot of nonpecuniary benefits. Giving B authority solves this problem without leading B to take advantage of A in the same way because A has a bigger incentive to protest.

3 The Delegation of Decision Making

In the previous section, the employee in authority communicated the valuations of both employees to top management. In the absence of protests, top management used this information only to adjust employee wages. Since employee wages do not appear to be adjusted every time a decision is made it might be more realistic to assume that costs of information transmission prevent the firm from knowing the employee's valuations. In this section, I will suppose that, indeed, top management remains ignorant of these valuations unless there is a protest. Protests, as before, do reveal the benefits that employees derive from various possible projects. If a protesting employee incurs the cost C_2 and the employee in authority incurs the cost C_3, the firm does learn the valuations for both the project that has been originally proposed and for the one favored by the protesting employee. Thus, after a protest, the situation is identical to the one considered before.

In the absence of any protests, however, there is a difference. In particular, there is no communication about projects between the employee in authority and top management. Thus, the employee in authority looks "as if" he had discretion over the decision in question. It appears that decision making itself has been delegated to the employee in authority.

Rather than carry out this analysis in general, I focus on a special case in which the parameters are such that the firm loses nothing from making wages insensitive to decisions. The advantage of this special case is that the firm's preference regarding who should be put in authority is the same whether the valuations of the two employees are transmitted or not. The reason is that, in this special case, the firm gains nothing from the transmittal of valuations by the person in authority.

That such a special case can be constructed at all is of course of independent interest. The reason is that one does not see continuous adjustment of employee wages as decisions are made inside firms. This can of course be rationalized by the sorts of costs of information transmission alluded to above. However, because the cost of transmitting credibly the valuations associated with just one project are probably not all that great, one would be worried about the lack of wage adjustment if one thought the firm had a great deal to gain from this information. The existence of a special case where the firm gains nothing from knowing the employee's valuations suggests that, in general, the gain from such knowledge is relatively low so that keeping wages constant is relatively costless.

The reason keeping wages constant can be optimal is that, as we saw, an employee who gains nonpecuniary utility from a decision generally sees his total compensation rise as a result. In other words, it is not profit maximizing to cut the employee's wage by his full nonpecuniary gain. Thus, it is not surprising that there are parameter configurations that lead to an increase in employee compensation that is exactly equal to the nonpecuniary gain.

I conduct the analysis in two steps. In the first, I show the conditions on the z's and the y's that are needed to ensure that a policy of constant wages in periods 1 and 2 implies that total employee compensation is y_3^i when the project is worth h, y_2^i when it is worth ℓ and y_1^i otherwise. Moreover, these conditions also ensure that, with this policy of constant wages the employee remains in period 2 only when his valuation is h. In the second step, I assume that these conditions on parameters are satisfied and I rewrite the conditions needed for this pattern of compensation to be optimal as well as the condition that implies that B should

be given authority. I then show with a numerical example that all these conditions can be satisfied at once. In effect, this numerical example also shows more generally that the conditions I wrote down in the previous section are all compatible with one another.

Proposition 2: *If (4),(6),(7), (11),(12),(16),(17) hold while (9) holds for both employees when x is ℓ but fails for both when x is h while*

$$z_2^i = z_1^i + h \tag{33}$$

$$y_2^i = y_1^i + \ell(1 + P) \tag{34}$$

and

$$y_3^i = y_1^i + h(1 + P) \tag{35}$$

the firm loses nothing from its inability to observe the valuations of the project that is actually implemented.

Proof: I will prove that the firm cannot earn more than by paying z_1^i in the second period and paying $[y_1^i - Pz_1^i - (1 - P)z_2^i]$ in the first period regardless of what project is implemented. Since these wages are independent of the level of nonpecuniary utility, the firm loses nothing from its ignorance of the employees' valuations.

Given that (4) holds, the firm wants to pay z_1^i in the second period when the project does not provide the employee with any nonpecuniary utility. Thus, z_1^i is optimal in this case. The failure of (9) when x equals h implies the firm wishes the employee's compensation to equal z_2^i when the project that has been implemented gives h to the employee. But, (33) implies that, in this case, this level of compensation accrues to the employee when his in this wage equals z_1^i. Thus, once again, z_1^i is optimal and ensures that the employee stays with probability one in this case. The fact that (9) holds when x equals ℓ case implies that the firm would pay the employee $z_1^i - \ell$ (rather than z_1^i) if it knew that the project gave him ℓ of nonpecuniary utility. While z_1^i is not the wage would pay in this case, it is important to note that the wage of z_1^i still leads the employee to depart when his outside offer equals z_2^i because (33) implies that $z_1^i + \ell$ is less than z_2^i.

Conditions (6) and 7) imply that the wage of $[y_1^i - Pz_1^i - (1 - P)z_2^i]$ is indeed optimal when the project gives the employee no nonpecuniary utility. Conditions (11),(12) imply that the firm wishes to give employee i a present value of compensation equal to y_3^i when he gets h of nonpecuniary utility. Given a wage of z_1^i in

the second period, this requires a first period wage of

$$y_3^1 - 2h - z_1^i = y_1^i + (1+P)h - 2h - z_1^i = y_1^i - Pz_1^i - (1-P)z_2^i$$

where the first equality uses (35) while the second equality uses (33). Thus, $[y_1^i - Pz_1^i - (1-P)z_2^i]$ is optimal once again.

Conditions (16) and (17) imply that the firm wishes to ensure that employee i gets a present value of compensation equal to y_2^i when his nonpecuniary utility equals ℓ. Given that the employee stays with probability P in the second period and receives a wage of z_1^i if he stays, this requires a first period wage of

$$y_2^i - (1+P)\ell - Pz_1^i - (1-P)z_2^i = y_1^i - Pz_1^i - (1-P)z_2^i$$

where the equality is implied by (34). Thus, $[y_1^i - Pz_1^i - (1-P)z_2^i]$ is optimal in all cases. Note that this wage offsets the fact that the employee is paid "too much" in period 2 when his nonpecuniary utility is ℓ. Thus, the firm loses nothing paying z_1^i in period 2 when the employee gets this level of nonpecuniary utility.

■

The equalities (33), (34) and (35) imply that, focusing just on employee A and leaving aside employee B, there are only 8 independent parameters, namely v^A, z_1^A, y_1^A, P, h, ℓ, P_1 and P_2. Proposition 2 assumes that 9 conditions hold. However, the fact that (9) holds when x equals ℓ implies that (4) holds as well. In addition, there are the conditions (1) and (3), although these are implied by (33), (34) and (35) as long as $h > \ell > 0$. Finally, there is the condition (2). Since some of these conditions are highly nonlinear, there appears to be no simple method to check whether parameters can be found that satisfy them all simultaneously.

I thus show that there exist numerical values for the 8 independent parameters such that all the relevant conditions hold. Before, doing so, I rewrite the 8 independent conditions assumed in Proposition 2 in terms of the eight independent parameters. Condition (9) when x equals ℓ is now

$$(1-P)(v^i + \ell - z_1^i) < h \tag{9'}$$

whereas its failure when x equals h is

$$(1-P)(v^i - z_1^i) > Ph \tag{9''}$$

Using primes to denote the transformed conditions, the rest of these are

$$P_2[v^i(1+P) + z_1^i(1-P) - y_1^i] < (P_1+P_2)(1+P)\ell - P_2(1-P)h \tag{6'}$$

$$(1 - P_1)[v^i(1 + P) + z_1^i(1 - P) - y_1^i] < [2P + P_1(1 - P)]h \tag{7'}$$

$$(1 - P_1)(2v^i - y_1^i) > (P + P_1)h \tag{11'}$$

$$(1 - P_1 - P_2)(2v^i - y_1^i) > (P - 1 - 2P_1 - 2P_2)h + (1 - P_1 - P_2)(1 + P)\ell \tag{12'}$$

$$P_2[v^i(1 + P) + z_1^i(1 - P) - y_1^i] > P_1(1 + P)\ell - P_2(1 - P)h \tag{16'}$$

$$(1 - P_1 - P_2)[v^i(1 + P) + z_1^i(1 - P) - y_1^i] < 2Ph - (1 + P)\ell \tag{17'}$$

assuming that y_1^i, z_1^i, P, P_1, P_2 and h are given respectively by 8, .1, .5, .3, .3 and 11 respectively, these conditions are satisfied as long as v^i is between 11.2 and 13 and as long as ℓ is between 5.7 and 9. The fact that the conditions are satisfied for a relatively broad range of parameters implies that one can find parameters that are consistent with (32) as well as for parameters that are not.

Condition (32) tends to be satisfied for relatively large values of $g(\ell, 0)$. In general, $g(\ell, 0)$ is increasing in ℓ. To preserve the equalities of Proposition 2, however, y_2^i must be increased together with ℓ so that any increase in ℓ is matched by the need to pay the employee a higher present value of earnings. The result is that, since wages and the probability that the employee remains are independent of ℓ, local changes in this parameter do not affect profits.

It is feasible to increase $g(\ell, 0)$ by raising P_2, the probability that the employee actually stays when he is given a nonpecuniary utility of ℓ. Using the above parameters with ℓ equal to 9 and letting $\lambda_1 = \lambda_2 = \lambda_3$, (32) is violated so that it is better to give authority to A. If P_2 is raised to .4 and all the other parameters are kept constant then all the conditions of Proposition 2 continue to be met but (32) is satisfied as well. In this case, giving authority to B is optimal.

4 Conclusions

The setting I have considered is obviously stylized. However, it shows how one can deal formally with organizational design issues in situations where the firm want to allocate power differentially to different employees. One obvious extension involves consideration of a setting where there are more than two employees. This would allow one to deal with situations where people are divided into departments and where some of the power is departmental power as opposed to individual power. Because departments contain different

individuals at different points in their life-cycles that may require an overlapping generations model of the sort considered in Rotemberg (1993).

For the model to provide a positive theory of organizational charts, it also must be extended in another direction. In particular, the model will have to include not only "strategic" decisions whose effects are long lasting but also operational (or day-to-day) decisions. In practice, hierarchical control over day-to-day decisions is linked to formal authority over more lasting choices. Perhaps this is because operational control makes it easier to know the benefits that accrue from different potential strategic choices. This interplay between learning, operational control and strategic decisions needs further exploration if the model is to be used to understand organizational charts.

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